Claims

[1] A medical imaging diagnostic apparatus that obtains image data from a blood vessel of an object being examined and measures the composite thickness of a tunica intima and a tunica media of the blood vessel, comprising extraction means for extracting the tunica intima and the tunica externa of the blood vessel based on the brightness information of the image data, wherein the composite thickness of the tunica intima and the tunica media of the blood vessel is measured based on the extracted two regions.

[2] The medical imaging diagnostic apparatus according to claim 1, wherein the extraction means sets a reference point and a threshold value based on the brightness distribution information in the thickness direction of the blood vessel, and extracts the region having the pixel value within the threshold value range from the reference point.

[3] The medical imaging diagnostic apparatus according to claim 2, comprising means to make the threshold value variable.

[4] The medical imaging diagnostic apparatus according to claim 2, wherein the region including the lumen, tunica intima, tunica

media and tunica externa of the blood vessel is set, and the tunica intima and tunica externa within the region are extracted.

[5] The medical imaging diagnostic apparatus according to claim 2, comprising setting means for setting a local maximal point which is close to the side of the lumen and has the maximum brightness gradient as a tunica intima reference point.

[6] The medical imaging diagnostic apparatus according to claim 5, wherein:

the setting means sets the first region of interest in the position equivalent to the lumen, and the brightness difference between the average brightness within the first region of interest and the brightness of the tunica intima reference point as the threshold, and;

the extraction means extracts the tunica intima based on the set threshold.

[7] The medical imaging diagnostic apparatus according to claim 6, wherein the extraction means determines that the pixels having the brightness, when the absolute value of the brightness difference is smaller than the threshold value, are equivalent to a tunica intima.

[8] The medical imaging diagnostic apparatus according to claim 5, wherein a plurality of brightness distribution lines running in the diameter direction of the blood vessel (depth direction) and in a blood vessel direction, are obtained, and the tunica intima reference point is obtained based on the average brightness distribution line of the obtained respective distribution lines.

[9] The medical imaging diagnostic apparatus according to claim 5, wherein a local maximal point closest to the lumen side, from the local maximal point previously set as the tunica intima reference point, is reset as a tunica intima reference point.

[10] The medical imaging diagnostic apparatus according to claim 1, wherein the tunica intima is obtained based on the color distribution of the Doppler signals of reflected echo signals.

[11] The medical imaging diagnostic apparatus according to claim 10, wherein a binarization process is implemented, and the tunica intima is obtained based on the result of the binarization process.

[12] The medical imaging diagnostic apparatus according to

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claim 2, wherein the setting means sets the coordinate of the point having the maximum brightness value in relation to the brightness distribution in the thickness direction as a tunica externa reference point.

[13] The medical imaging diagnostic apparatus according to claim 12, wherein:

the setting means sets the second region of interest between the tunica intima reference point and the tunica externa reference point, and the brightness difference between the average brightness within the second region of interest and the brightness of the tunica externa reference point as the threshold value, and;

the extraction means extracts the tunica externa based on the set threshold value.

[14] The medical imaging diagnostic apparatus according to claim 1, comprising signal processing means having a filter for emphasizing the contour of the pixel region being extracted by the extraction means.

[15] The medical imaging diagnostic apparatus according to claim 1, wherein:

the image data is 3-dimensional, and

the extraction means extracts the tunica intima and the tunica externa on the 3-dimensional region, and measures the composite thickness of the tunica intima and a tunica media.

[16] The medical imaging diagnostic apparatus according to claim 1, comprising:

a probe for transmitting/receiving ultrasonic waves to/from an object being examined;

a transmission/reception unit for providing driving signals to the probe and receiving the reflected echo signals;

an image construction unit for reconstructing ultrasound images based on the reflected echo signals; and

a display unit for displaying the ultrasonic images,

wherein the image data is the ultrasound image data obtained by transmitting/receiving ultrasonic waves to/from the object.

[17] The medical imaging diagnostic apparatus according to claim 16, wherein a blood vessel wall on the side near the probe is set as a near wall and a blood vessel wall on the side far from the probe as a far wall, the measured value of the near wall and far wall are compared to each other, and the greater value thereof is set as the measurement value of the cross section.

[18] The medical imaging diagnostic apparatus according to claim 1, comprising calculation means for calculating the average value of the measured value in the region being extracted based on the extracted region.

[19] The medical imaging diagnostic apparatus according to claim 1, comprising:

calculating means for calculating a maximum value or a minimum value in the extracted region, and;

a display unit for displaying the calculated value,

wherein the location of the maximum value or the minimum value in the extracted region is marked on the display unit.

[20] The medical imaging diagnostic apparatus according to claim 1, comprising:

calculating means for calculating the distance between the boundaries of an inner wall of the tunica intima and an inner wall of the tunica externa, and;

display means for displaying the composite thickness of the tunica intima and tunica media of the blood vessel based on the distance.

[21] A medical imaging diagnostic apparatus comprising:

imaging means for obtaining image data relating to a blood

vessel of an object being examined;

brightness distribution acquisition means for obtaining the brightness distribution in the thickness direction of the blood vessel in the image data;

setting means for setting the local maximal point, out of local maximal points appearing in the brightness distribution, on the lumen side as a tunica intima reference point, and the local maximal point having the maximum brightness as the tunica externa reference point;

extraction means for extracting the pixels, in relation to the respective pixels within the setting range including the tunica intima reference point or the tunica externa reference point, wherein the brightness belong to the setting range;

calculation means for calculating the distance between the boundary in the blood vessel side of the region formed by the pixels being extracted based on the tunica intima reference point and the boundary in the lumen side of the region formed by the pixels being extracted based on the tunica externa reference point; and

a display unit for displaying the result of the calculation.

[22] The medical imaging diagnostic apparatus according to claim 21, wherein the setting range of the extraction means is from the brightness of the tunica intima reference point to the

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average brightness of the setting range equivalent to the lumen, or from the brightness of the tunica externa to the average brightness of the setting range equivalent to the spacing between the tunica externa reference point and the tunica intima reference point.

[23] A medical imaging diagnostic apparatus comprising:

imaging means for obtaining image data related to a blood vessel of an object being examined;

Doppler imaging means for obtaining color Doppler image data related to the blood vessel;

brightness distribution acquisition means for acquiring the brightness distribution in the thickness direction of the blood vessel wall of the color Doppler image data;

setting means for setting the local maximal point, out of the local maximal points appearing in the brightness distribution, having the maximum brightness as the tunica externa reference point;

extraction means for extracting the pixels, in relation to the respective pixels within the setting range including the tunica externa reference point, wherein the brightness belongs to the setting range; and

calculating means for calculating the distance between the boundary of the lumen and the tunica intima being obtained based

on the color information and the boundary in the lumen side of the region formed by the pixels being extracted based on the tunica externa reference point.

[24] A medical imaging diagnostic method including:

a step for obtaining image data related to a blood vessel of an object being examined;

a step for obtaining the brightness distribution in the thickness direction of the blood vessel wall of the image data;

a step for setting, out of the local maximal points appearing in the brightness distribution, the local maximal point in the lumen side as the tunica intima reference point and the local maximal point having the maximum brightness as the tunica externa reference point;

a step for extracting the pixels, in relation to the respective pixels within the setting range including the tunica intima reference point or the tunica externa reference point, wherein the brightness belongs to the setting range;

a step for calculating the distance between the boundary in the blood vessel wall side of the region formed by the pixels being extracted based on the tunica intima reference point and the boundary in the lumen side of the region formed by the pixels being extracted based on the tunica externa reference point; and

a step for displaying the result of the calculation.